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SCENERY AND GEOLOGY

IN

COUNTY ANTRIM.

BY

GRENVILLE A. J. COLE, M.R.I.A., F.G.S.,

Professor of Geology in the Royal College of Science for Ireland.

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WITH the general cheapening of modes of locomotion and the removal of ancient obstacles, a great change has come over the character of civilised man. He has found a new pleasure; he travels for pure enjoyment; and, as a rule, the more he travels, the more does he desire to know.

Those early bands of tourists, the nomadic hordes of Asia and Central Europe, travelled under a certain compulsion, having eaten up or outgrown their ancient pasture-lands. At length, when a tribe had become agricultural, had settled down, and had built for itself markets and walled cities, other bands of tourists travelled into the area with the object of pillage and spoliation. Travelling of this kind, as practised by the Tartars and the Huns, was exciting, but could hardly be regarded as a healthy recreation for the masses. The great travellers of a more settled time, journeying with the traders' caravans, usually had leanings towards commerce or ultimate annexation. But, in our own day, the demand for greater leisure

has largely arisen on account of the greater means we possess for rational enjoyment; and travel, whether for ten miles or ten thousand, provides most of us with the keenest form of holiday-relaxation.

As we said at the outset, man now desires to know; he enquires about the inhabitants of a country, about their history, their antiquities, their art. The fascination of such subjects has led thousands of travellers to Venice, to Florence, and to Rome; and they have crossed the Alps with scarcely a suspicion that the most wonderful, the most far-reaching history of all lay written in the rocks of that gigantic mountain-chain.

Now, however, the enjoyment of scenery is leading us to ask about the history and the origin of the rocks themselves; we see hills of a particular type, and wonder what is the cause of their special outlines; we gather specimens as souvenirs, and find that in them we may read some of the most remarkable changes that the country round us has undergone.

The term "Geology" may alarm some people; but everyone can be in his way a geological observer. The British Isles, with their remarkable variety of rocks and fossiliferous deposits, form everywhere a tempting field; but it can be asserted with confidence that no county of the three kingdoms offers so many geological features, displayed with such clearness and picturesqueness, as does the beautiful County of Antrim.

In these few pages we propose to give a sketch of the ancient history of this area, referring especially to those places most freely accessible to the tourist. It is fortunate that Co. Antrim has in Mr. R. Welch an artist who

is himself a keen geological observer, and his photographs form the best possible illustrations of the notes which follow here.

Geologists have divided the long past history of the earth into four great *eras*, and have sub-divided these again into *periods*, marked by the various remains of plants and animals that are found in successive layers of the rocks. It will be convenient at the outset to put the names of these time-divisions in a tabular form, the oldest being at the bottom of the column.

ERAS.	PERIODS.
IV. CAINOZOIC or TERTIARY.	14. Post-Pliocene and Recent, including the present day. 13. Pliocene. 12. Miocene. 11. Oligocene. 10. Eocene.
III. MESOZOIC or SECONDARY.	9. Cretaceous. 8. Jurassic. 7. Triassic.
II. PALÆOZOIC or PRIMARY.	6. Permian. 5 Carboniferous. 4. Devonian. 3. Silurian. 2. Ordovician (or "Lower Silurian.") 1. Cambrian.
I. ARCHÆAN.	Not divided into periods, owing to absence of fossil remains.

ARCHÆAN ERA.

The oldest rocks that we know in Co. Antrim are exposed in the north-east only. Doubtless they underlie all the county, covered over by the sandstones and clays, limestones and volcanic masses, of far later periods. They form, in fact, the ancient floor of Ireland, the earliest land of which we have any knowledge in this area, and are older than the first certain traces of life upon the globe. The rocks are what are called *Schists* and *Gneisses*, formed out of others that have been squeezed during long periods of pressure and earth-movement. The schists show surfaces of gleaming mica when broken; the gneisses are coarser and contain knots of quartz and felspar. So folded and crumpled has this ancient land become, that it is difficult to say what was the original condition of its rocks. We call them broadly a "metamorphic series," rocks highly altered by heat and pressure. They come to the surface again to the south-west of Limavady, and form the great rolling highlands of western Derry and Donegal.

Glendun has been cut through this ancient series; on either side, as we go up the winding road from Cushendun, we see the rounded slopes, capped with broad curves of bog-land, contrasted with the steep scarps of the later formations in the south. A wild and picturesque continuation of the coast-road runs high upon the slopes of these schists from Cushendun to Torr. This route, easily accessible in the reverse order from Ballycastle, brings one across steep combes and headlands rivaling those of Devonshire; and at Torr Head the characters of the gneiss, which in great part resembles a crushed grit, can be studied in one of the most charming inlets of the coast. A fine feature of the scene is

the great mass of Kintyre, rising boldly across the channel, where these old rocks are continued northward into the central Scottish highlands.

PALÆOZOIC ERA.

Unless their relics have been crushed up beyond recognition among the old fundamental rocks, we have, with one small exception which we note below, no representatives in Co. Antrim of the long CAMBRIAN, ORDOVICIAN, and SILURIAN periods. The traveller from Dublin will have seen ancient slates and sandstones, possibly Cambrian, in the promontory of Howth; he will have passed over upturned Ordovician strata in the neighbourhood of Skerries and Balbriggan; and he has only to cross from Belfast into Co. Down to find himself in a great Ordovician area. The fringe of these slaty beds comes, indeed, within Co. Antrim, close to Lisburn and Dunmurry; and no doubt Ordovician rocks also underlie many of the newer beds upon the west.

Whatever Co. Antrim was in Archæan and Cambrian times, whether it was dry land, hummocky and mountainous, like the present region of Glendun, it certainly must have been largely submerged during the Ordovician period. These marine muds and sands spread doubtless far across it; and in Silurian times it probably again was uplifted, like so much of eastern Ireland. In the hollows of the continental land thus formed, great lakes began to gather; and this leads us to the next set of rocks displayed in Co. Antrim.

All over the north and centre of the British Isles, the DEVONIAN period is known by freshwater deposits. Few of these are more remarkable than the accumulation of sands and conglomerates extending from Cushendun to Cushendall. These beds form a ridge cutting off the view of the sea as

the road swings inland from Cushendall; and at the Caves of Cushendun they may be studied in a number of picturesque and natural excavations. Cushendun would be worth visiting for the sight of the conglomerates alone. These dusky red-brown pebble-beds, formed probably on some old Devonian beach, have been uplifted and crushed together, so that most of the hard pebbles have been cracked through and through. The most striking feature, however, is the magnificent coarseness of the materials. Some of the pebbles are two feet in length, and most of them are as large as a man's fist. Here and there white sands, or a few gritty beds, seen on the shore south of the caves, serve to remind one of ordinary beach-deposits; but the conglomerates, so well shown on the vertical walls, give one a tremendous picture of the rolling power of the waves. The materials were brought down by rivers from the neighbouring highlands, which were formed of Archæan and Ordovician rocks; they were rounded in part during their progress, but received their finishing touches from the wave-action on the shore of the old lake. When we say that these conglomerates are of Devonian age, we have no fossils to guide us, and we can only compare them with the deposits of other areas. All we know for certain is that they lie between the Archæan and the Trias.

Gradually the lakes and their surrounding uplands sank throughout Ireland beneath the sea; and it is hard to say if anything but a few islands was left of the old country by the time that the middle of the CARBONIFEROUS period was attained. One of these islands probably arose in Co. Antrim. The Carboniferous beds occur around Fair Head, from Drumnakill in Murlough Bay to the river-mouth at Ballycastle, and they consist of shales, limestones, and

sandstones, clearly deposited near a coast. Abundant plants have been washed down into them from the Carboniferous land, and have given rise to the coal-seams that are mined in Colliery Bay. These coal-beds, like those near Edinburgh, are far older than the well-known "Coal-measures," which mark the upper part of the Carboniferous system, as at Dungannon and elsewhere throughout Ireland.

East of Ballycastle the yellow sandstones form a pleasing feature of the coast. Stems and branches of the lowly Carboniferous trees may often be seen in the blocks by the wayside. The successively deposited layers of the rock form an admirable example of a "stratified" series, sandstone alternating with fine seams of clay. The beds have been broken through by molten masses of basalt, and are dominated by the imposing sea-front of Fair Head, which we shall return to in our notes on Eocene times.

Probably in due time, as the land was again raised, the Carboniferous forests spread over Co. Antrim; but their deposits have since been swept away or hidden under Triassic beds. Even in this period, the highest known animals that could have inhabited the county were amphibians; and not even a true reptile had yet arisen on the globe.

We have no traces of the PERMIAN period in Co. Antrim. But the next era opens with a characteristic series of deposits.

MESOZOIC ERA.

The Mesozoic beds of the north-eastern counties are of special importance, because strata of their age can be studied in no other part of Ireland. They owe their preservation thus locally to the great capping of volcanic material poured out

on them in Cainozoic times, and they are exposed as a sort of fringe round about the scarp of the plateau-basalts. They have been in great part altered and baked by these once molten masses; and visitors familiar with the Mesozoic rocks of England, with the Cotteswolds, the Chilterns, or the Surrey hills, will study with additional interest these picturesque relics in the north of Ireland.

The TRIASSIC rocks, like most of the Devonian in the British Isles, were deposited in lakes, until at last the marine Rhaetic series closed the period. Red sandstones and red and greenish clays were accumulated, very poor in fossils; and the evaporation of the lakes in a dry climate gave rise in many parts to deserts. At the present day the Great Salt Lake of Utah, with two smaller sheets of water, form the relics of an old lake of vast extent, the floor of which now constitutes the Utah desert. As lakes dry up, the materials dissolved in their waters are left behind; the water becomes salter and salter, and finally deposits are formed at the bottom, among the sands or clays that still accumulate from the shore. The two materials most conspicuously produced are *Rock-Salt* and *Gypsum*; the latter is a soft, white, crystalline substance, a hydrous sulphate of lime, which is used for making Plaster of Paris, and, in its massive forms, for sculpture, under the name of Alabaster. North-east of Belfast, near Carrickfergus, the Triassic lakes have thus supplied the locality with a salt-mining industry; while veins of gypsum may often be seen in sections of the red deposits. Between White Head and Cloghan Point, where the railway to Larne has been cut into these beds, the white veins are excellently seen. The deposits of rock-salt at Carrickfergus amount in all to the handsome total of some eighty feet in thickness. The

chimneys of the mines can be seen on the left while journeying to Larne.

The red sandstones and conglomerates of the Triassic period have originated the name Red Bay, between Garron Point and Cushendall.

The highest beds of the Trias are, as already hinted, marine, and form the *Rhætic Series*. The sea once more spread over England and eastern Ireland, and found its shore somewhere in the highlands of Donegal. On Cave Hill, in the fine quarries nearest to Belfast, the Rhætic beds are seen as blackish clays, with numerous marine molluscs; the lower slopes of the hills are formed of the earlier lake-deposits, and the rocks of the upper scarps belong to the Cretaceous and the Eocene periods.

Before leaving the Triassic period, we ought to note the beautiful exposure of the sandstones in the quarries at Scrabo Hill in Co. Down, south-west of Newtownards. Here the ripple-marks in the old lake-floor are magnificently preserved in slab after slab of the pink brown rock, and the prints of rain-drops are abundant. When we add that intrusive sheets and veins of basalt can be studied in the same fine sections as clearly as they can on the slopes of Etna or in Auvergne, we shall have said enough to send any geologist to Scrabo Hill.

The opening deposits of the great JURASSIC period, forming what is known as the *Lower Lias*, were marine, and were laid down quietly in continuation of the Rhætic clays. By this time reptiles had freely arisen, had asserted themselves, and had become predominant. Traces of the great sea-lizards have been found in the Belfast area; other lizards flew through the air; others, twenty to

eighty feet in length, trampled heavily about the land. The humblest mammals, a class that had arisen in the Triassic period, ran between their legs, doubtless in a state of terror and suspense, and, yet by their superior cunning, finally managed to survive.

The thin Jurassic clays of Co. Antrim are abundantly fossiliferous around Larne Lough. They are best known to tourists by their effect on the landscapes of the coast-road, especially in the stretch from Glenarm round into Red Bay. Here the weight of white limestone and basalt resting on them produces continual landslips; the water accumulates in the limestone and lubricates the surface of the Lias clays. Hence, huge blocks of the coast move bodily outwards, and even the great slip at Garron Point, giving us the long terrace on which Garron Tower stands, may be attributed to the same cause. Behind the mansion, the limestone and basalt reappear in their proper place, some 180 feet higher than in the terrace.

Close to the Railway Hotel at Portrush, the Liassic beds have a very special interest. They contain fossils (Ammonites and so forth), and have been baked and hardened by neighbouring masses of basalt and dolerite, which have intruded into them in a molten state. Hence they come to have a flinty fracture, and to closely resemble basalt, the typical volcanic rock of Co. Antrim. At the end of the last century, controversy was running very high as to whether the basaltic and allied groups of rocks were really volcanic, or were deposited chemically from the sea. The two schools of opinion were called Vulcanists and Neptunists respectively, and the latter quoted the Portrush Lias as evidence of a fossiliferous basalt. It is needless to say that they were quite defeated in the end.

Only the earliest beds of the Jurassic period are represented in Ireland. A long period of upheaval followed, and then renewed submergence produced still more interesting deposits.

The CRETACEOUS rocks may easily be studied under the great basalt edge almost all round the country. As we enter by Lisburn and Belfast, we may see the white quarries gleaming high up on the steep face of the hills upon our left; along Cave Hill there are several fine excavations, and these are merely a gentle preparation for the bold series of cliffs and tumbled headlands that are the glory of the Antrim coast-road. At Portrush and White Park Bay the same rocks rise pure and white above the grey-green water and the surf, and, with the grim basalts that cap them, form one of the finest contrasts of colour in the British Isles. The study of these Cretaceous masses at Portrush is made still more attractive by the varied series of caves and natural arches worn in them at the Whiterocks by the sea. The scene would be a beautiful one as a mere example of marine erosion; and the lines of flints, the rectangular jointing, the fossils, and above all, the purity of the limestone, give it peculiar interest to the geologist.

In England the chalk is a soft limestone, extending over wide open areas, poor in streams. In Ireland, however, it has been so compacted and baked by the Cainozoic volcanic outbursts that it has become a firm *White Limestone*, in places splintery on fracture, and containing quartz-crystals and chalcedony in some of its most altered portions. At its base are more sandy beds, sometimes conglomeratic, with quartzite pebbles worn from the old land; near Belfast the lowest beds are coloured a rich green by abundant grains of *glauconite*. This mineral is formed at the present day

inside the shells of minute sea-organisms, especially about 100 fathoms from the surface; while the chalk or "white limestone" is itself the consolidated representative of the shelly oozes that are being deposited in existing oceans. It was formed in a pure sea, but not necessarily in a very deep one; while probably, as was the case in Jurassic times, continental lands stretched away to west in Donegal, and along the line of the outer Hebrides.

All along the delightful borders of the basalt, the contrast of limestone and dark volcanic rocks makes continual variety in the landscape; and the visitor familiar with eastern England will be surprised at seeing waterfalls and little streams rushing down from the moorland-plateau, and coursing through white gullies in the chalk.

CAINOZOIC ERA.

The making of Co. Antrim, as we now know it, and the preservation of so many interesting deposits, depended upon the extraordinary volcanic activity that began in EOCENE times. The chalk was upheaved and partly worn away; the flints from it were scattered as a coarse gravel over the surface; and then volcano after volcano broke through the rolling downs, and poured vast *lava-flows* into every hollow, obliterating the surface-features and forming plateaux right across the country.

The flint-gravels may still be seen, as along the front of Cave Hill, forming a baked and reddened band between the basaltic lavas and the chalk. The lavas themselves form the great dark-edged upland.

A local volcano at the Tardree Mountain, north of Antrim town, gave vent to *rhyolites*, lavas much richer in silica and paler in colour than those prevalent in the county.

The predominant rocks are true black *basalts*, compact and heavy, the iron in them weathering out as a warm brown rust upon their surfaces.

If a foreigner were asked to name any one feature for which Ireland is famous, he would reply at once, "The Giant's Causeway." And the area of the Causeway is so typical of the volcanic scenery that we may as well visit it at once.

A great lava-flow cools from its two surfaces in quite different fashions. The upper part is exposed to the air, is rendered rubbly and broken by escaping gases, is more free to move than the lower masses, and thus cools with a structure of somewhat irregular shrinkage-cracks, which here and there give rise to columnar jointing on a small scale. This splitting of a consolidating material into columns while it shrinks is well illustrated by the structure of commercial starch.

Now, the lower part of the lava-flow cools more steadily and slowly, and is held by the ground across which it has been poured; the result is a shrinkage-structure on a much bolder scale, columns arising at the lower surface, and shooting up, as the cracks spread, towards the interior of the mass. The famous Causeway is the lower part of such a flow, the upper part being worn away; and the jointing has gone on with unusual regularity and neatness, the curved cross-joints, now with their concavity, now with their convexity upwards, being especially beautiful and well developed.

The Causeway, however, is only an incident in a striking series of volcanic landscapes. In the cliffs around it, tier after tier of lava can be traced, strongly columnar in places,

and with beds of *ash* (the fragmental lava exploded from the volcanoes) sometimes lying between the successive flows. Occasionally a long interval elapsed between one lava-flow and another, and the weather produced a red soil, which has been preserved by the next outpouring. The most striking of such deposits is the *pisolitic iron-ore* of Co. Antrim, which occurs mainly at one level in the series of basaltic eruptions. The little pea-like knots of iron oxide doubtless gathered in lakes, which were formed on the surface of the older basalts. Similar deposits of ore occur in modern lakes and bogs, when iron is plentiful in the slopes around them. The bright red and brown ore is seen ready for shipment on the coast at Glenarm, and is mined along the Ballymena and Cushendall Railway.

In these lake-deposits the remains of plants have been found, which give us the clue to the Eocene age of the volcanoes of Co. Antrim.

Perhaps the finest landscape of the volcanic coast is furnished by Pleaskin Head, where the lavas rise boldly one above the other, the zone of iron-ore lying about midway up the cliff.

The lava-flows proceeded from a number of vents, many of which are doubtless hidden by later outpourings. But some of the plugs or *necks* of these volcanoes still remain. At the headland of Carrick-a-rede the vent has been choked up with a coarse agglomerate of lava-blocks and lumps of chalk, torn off from the older masses through which the volcano broke. The striking ridge of Slemish, east of Ballymena, 1437 feet above the sea, is the weathered-out core of one of the larger volcanoes, and is formed of a crystalline rock which cooled finally in the vent. Similarly,

the little hill of Tiveragh, overlooking the idyllic glens of Cushendall, is a basalt neck from which the surrounding ashes and lavas have been weathered away. We cannot expect, in such an exposed country, and through such long periods of time, to find any of the original forms of volcanic cones and craters left to us. For such phenomena we shall have to go as far southward as the volcanic Eifel or Auvergne.

In an area so beset by volcanic action, every crack formed in the heaving crust of the earth would at once be filled by the hot molten lavas. The resulting *dykes* weather out as dark wall-like ridges traversing the lava-flows or the older rocks. These dykes may be seen freely on the coast of the Causeway or in White Park Bay; Carrickfergus Castle is built upon a large one; and others are admirably developed in the quarries on Cave Hill, Belfast, where they cut through the white chalk and enter the basalts of the plateau.

The grandest intrusive mass in Co. Antrim occurs at Fair Head, where the rock has weathered out into the bold cliff so conspicuous from the harbour of Ballycastle. A walk across the headland, or a row round it, shows us the enormous columnar structure of the rock—a structure that gives rise to the sheer sea-front and to the huge blocks that form the talus at its foot. This great mass of *Dolerite*, or coarse-grained basalt, doubtless cooled below the surface, having penetrated among the Carboniferous and Mesozoic rocks during the period of volcanic activity. To the south of Ballycastle, the ordinary lavas occur upon Knocklayd, a most interesting outlying mass, with the chalk cropping out all round it and resting upon the old Archæan floor.

It is hard to leave this fascinating subject of the volcanic rocks of Antrim. All round us we soon grow familiar with the basalt-plateau, a heather-clad moorland above, bounded

by a bold vertical scarp; beneath it the white chalk peeps out at intervals, and lower down we meet the long curving slopes of red-brown Trias sand. The vale of Glenariff shows these features in all their characteristic beauty; and it is hard to say whether this striking series of landscapes is more delightful to the tourist when every hollow is full of leafy trees and undergrowth and bracken, or when each ledge and terrace of the hills is picked out in the clear winter sunlight by the gleaming of freshly fallen snow.

The volcanoes may have lived on into OLIGOCENE times; but that period, with the MIOCENE and the PLIOCENE, has left no certain traces in Co. Antrim. In POST-PLIOCENE or almost modern times the "Ice-Age" prevailed here, as elsewhere in our islands. The back of Fair Head, for example, is smoothed by glaciers, and numerous erratic blocks have been left stranded on it as the ice melted finally away. The lower grounds of the country, as near Belfast and Antrim, are covered with clays and sands and gravels, the general *Glacial Drifts*. In these, marine shells occur freely, and delicate foraminifera are common in the still more recent clays in the neighbourhood of Belfast. The evidence all tends to show that a submergence and a re-elevation of the county took place within Post-Pliocene times. The Curran of Larne is in itself a sign of elevation of the land. In the little cuttings near the Harbour Station we see that Larne is built upon a *raised beach*; and the shells of living molluscan species can be picked out among the rounded stones. Before the time of elevation of this beach, Man was already in the country, since flint implements may be freely found associated with these marine remains.

The archæologist, as is often remarked, at this point meets the geologist; and the two work together towards

our own historic times. Enough has probably been said to show the attractions of Co. Antrim for those who would learn the origins of the scenery through which they travel. To the amateur observer, as well as to the professional worker, it is hard to imagine a more delightful field; and other routes open temptingly from it, to the romantic land of Mourne in the south, or to the highlands of Donegal and the Atlantic seaboard in the west.

NOTE.—The maps of the Ordnance Survey, on the scale of 1 inch to 1 mile, are published geologically coloured, by the Geological Survey of Ireland, price 3s. each. The sheets dealing with Co. Antrim are as follows:—

No. 7—Portrush and Carrick-a-rede. 8—Ballycastle, Fair Head, and Torr. 13—Ballymoney. 14—Cushendall and Garron Point. 19—Kilrea. 20—Ballymena and coast S. of Glenarm. 21—Larne. 27—Area N. of Lough Neagh. 28—Antrim, Tardree Mountain, Cave Hill. 29—White Head, Carrickfergus, Holywood. 36—Belfast and Lisburn.

The explanatory memoirs to the above are as follows:—

To sheets 7 and 8 together, price 2s; sheet 13, 6d.; sheet 14, 1s. 6d.; sheet 19, 6d.; sheet 20, 1s.; sheets 21, 28, and 29, together, 3s; sheet 27, 1s. 6d.; sheet 36, 1s.

Scrabo Hill is included in sheet 37.

A complete series of Geological Photographs of the Antrim Coast and Glens has been taken by Mr. R. Welch, Irish View Publisher, Belfast, Catalogues may be had from him, or from the General Manager, Belfast and Northern Counties Railway, Belfast.

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